Air Quality Technical Report

$PM_{2.5}$ Quantitative Hot-spot Analysis

I-65, SR44 to Southport Road
(Segmented from SR44 to Main Street and Main Street to Southport Road)

A. Introduction

This technical report outlines the methodology, inputs and results of the $PM_{2.5}$ quantitative hot-spot analysis for the I-65, SR44 to Southport Road (segmented from SR44 to Main Street and Main Street to Southport Road) project in Indiana. The environmental document for this project is being developed as a Categorical Exclusion (CE). This report will be included as a technical appendix to the CE document when it is completed. The project is within the Central Indiana nonattainment area for the 1997 annual fine particles ($PM_{2.5}$) National Ambient Air Quality Standard (NAAQS).

On March 10, 2006, the U.S. Environmental Protection Agency (EPA) published a Final Rule (71 FR 12468) that establishes transportation conformity criteria and procedures for determining which transportation projects must be analyzed for local air quality impacts in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas. A quantitative PM hot-spot analysis using EPA's MOVES emission model is required for those projects that are identified as projects of local air quality concern. Quantitative PM hot-spot analyses are not required for other projects. The interagency consultation process plays an important role in evaluating which projects require quantitative hot-spot analyses and determining the methods and procedures for such analyses.

The air quality analysis for the I-65, SR44 to Southport Road project included modeling techniques to estimate project-specific emission factors from vehicle exhaust and local $PM_{2.5}$ concentrations due to project operation. Emissions and dispersion modeling techniques were consistent with EPA's latest quantitative PM hot-spot analysis guidance, "*Transportation Conformity Guidance for Quantitative Hot-spot Analysis in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*" (USEPA, 2013)[1] that was updated in November, 2013.

B. Interagency Consultation

The conformity rule requires that federal, state and local transportation and air quality agencies establish formal procedures for interagency coordination. This analysis included participation from the following agencies:

- FHWA Indiana Division and Resource Center
- Indiana Department of Environmental Management (IDEM)
- Indiana Department of Transportation (INDOT)
- Indianapolis Metropolitan Planning Organization (MPO)
- EPA Region 5

1 US EPA. 2013. Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas" (EPA-420-B-13-053) located online at: http://www.epa.gov/oms/stateresources/transconf/policy/420b13053-sec.pdf

Interagency consultation provides an opportunity to reach agreements on key assumptions to be used in conformity analyses, strategies to reduce mobile source emissions, specific impacts of major projects, and issues associated with travel demand and emissions modeling for hot-spot analyses. 40 CFR 93.105(c)(1)(i) requires interagency consultation to "evaluate and choose models and associated methods and assumptions." Per Section 2.3 of EPA's hot-spot guidance, "for many aspects of PM hot-spot analyses, the general requirement of interagency consultation can be satisfied without consulting separately on each and every specific decision that arises. In general, as long as the consultation requirements are met, agencies have discretion as to how they consult on hot-spot analyses."

For this project, an interagency consultation conference call was held on May 20, 2014. As a result of the meeting, a decision was made to proceed with a quantitative $PM_{2.5}$ hot-spot analysis, even though a formal determination was not made with respect to whether this project was determined to be a project of local air quality concern. Subsequent input from the ICG was provided via email consultation between May 29 and May 30, 2014. The meeting and review process were used to obtain feedback on the document text and technical analysis assumptions. **Exhibit 1** provides a summary of the meeting topics and the key decisions by the interagency consultation group (ICG). Additional consultation via email was conducted between June 26 and June 27 to review the preliminary version of the technical report, offer feedback, and to advance the document for public comment.

Exhibit 1: Key ICG Decisions on Quantitative Methods and Data

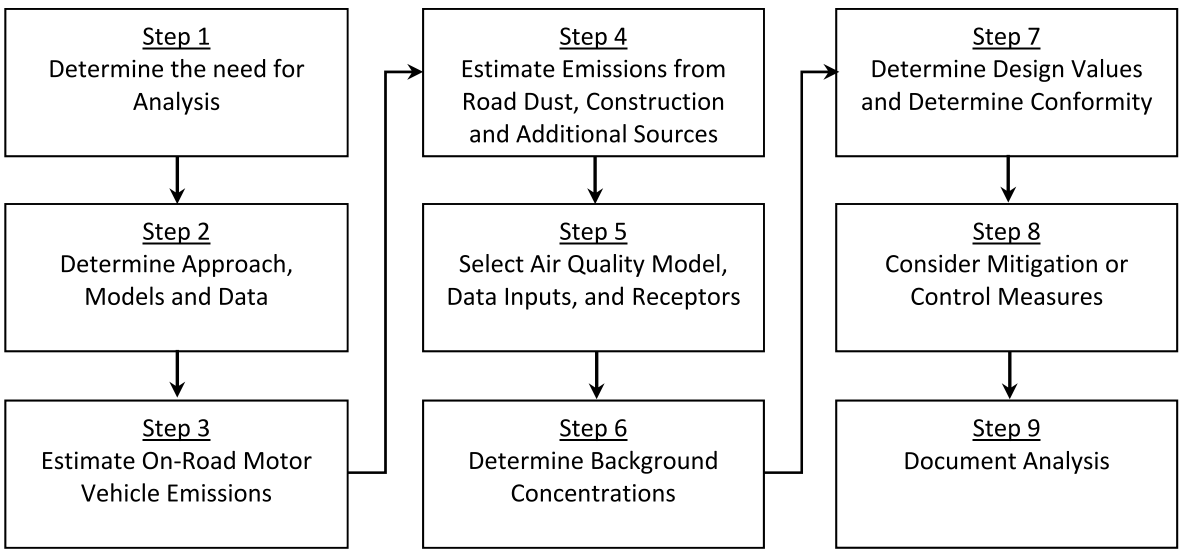
Topic	Key Decisions/Considerations
Analysis Approach	• Compare results of the Build analyses to the NAAQS.
Study Area	• Focus on the I-65 / Southport Road Interchange. It was determined this location was the location with highest emissions.
Analysis Years	• 2017
Type of PM Emissions Analyzed	• Direct $PM_{2.5}$ mobile source running emissions (exhaust, crankcase, brake/tire wear) • Construction emissions are not considered (< 5 years in duration) • No major non-road sources near the project location • Road dust is not considered a significant source
Emission and Air Quality Models	• MOVES2010b • AERMOD (run using "Area" method)
Background Concentrations	• Based on an average of three monitor locations • Average monitor reading 2011-2013 = 11.27
Receptor Locations	• Placed according to EPA guidance
Other Input Parameters	• MOVES inputs consistent with SIP/Conformity analysis by Indianapolis MPO • Recommendations from hot-spot training • AERMOD meteorology from IDEM

C. Overview of the Analysis Approach

EPA released updated guidance for quantifying the local air quality impacts of certain transportation projects for the $PM_{2.5}$ and PM_{10} NAAQS in November 2013. This guidance must be used by state and local agencies to conduct quantitative hot-spot analyses for new or expanded highway or transit projects with significant increases in diesel traffic in nonattainment or maintenance areas.

The steps required to complete a quantitative PM hot-spot analysis are summarized in **Exhibit 2**. The hot-spot analysis compares the air quality concentrations with the proposed project (the build scenario) to the 1997 annual $PM_{2.5}$ NAAQS. These air quality concentrations are determined by calculating a future design value, which is a statistic that describes a future air quality concentration in the project area that can be compared to a particular NAAQS. This report serves as documentation of the PM hot-spot analysis (Step 9) and includes a description of all steps.

Exhibit 2: EPA's PM Hot-spot Analysis Process



D. (Step 1) Determine Need for PM Hot-spot Analysis

Section 93.109(b) of the conformity rule outlines the requirements for project-level conformity determinations. A $PM_{2.5}$ hot-spot analysis is required for projects of local air quality concern, per Section 93.123(b)(1). The need for a quantitative $PM_{2.5}$ analysis for I-65, SR44 to Southport Road was discussed by the ICG. The project's environmental document is being developed as a CE, and it was noted that the project is located in a $PM_{2.5}$ nonattainment area with an increase in the number of diesel vehicles expected in future years. The ICG agreed that a project level hot-spot analysis would be conducted for I-65, SR44 to Southport Road. However, the group did not formally conclude that the project was a Project of Air Quality Concern.

E. (Step2) Determine Approach, Models and Data

Geographic Area and Emission Sources

PM hot-spot analyses must examine the air quality impacts for the relevant PM NAAQS in the area substantially affected by the project (40 CFR 93.123(c)(1)). It is appropriate in some cases to focus the PM hot-spot analysis only on the locations of highest air quality concentrations. For large projects, it may be necessary to analyze multiple locations that are expected to have the highest air quality concentrations and, consequently, the most likely new or worsened NAAQS violations.

The length of the project study area falls within the Indianapolis $PM_{2.5}$ non-attainment area. To assist in identifying the location of potential highest emissions, the ICG reviewed available traffic data including INDOT 2010 traffic counts and forecast (2035) no-build and build volumes from the INDOT Statewide Travel Demand Model (ISTDM). The average annual daily traffic (AADT) and truck percentages are summarized in Exhibit 3. Results from Indianapolis MPO regional traffic modeling were also evaluated to determine how local traffic patterns would likely be affected by the project.

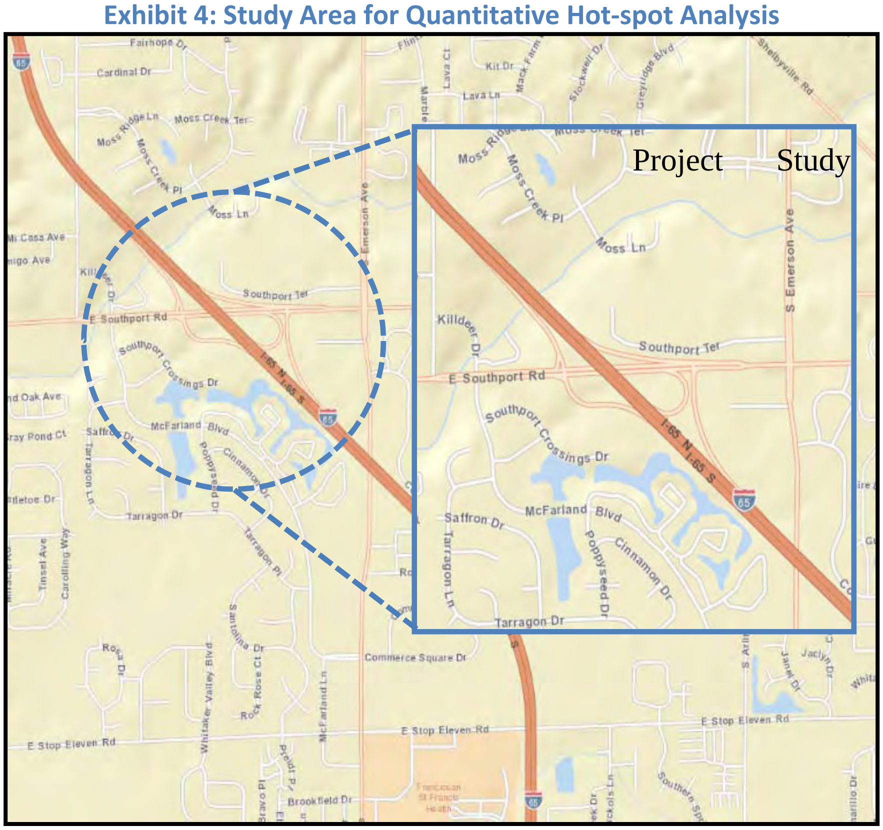
Exhibit 3: Current and Projected Traffic Volumes in Study Area

	2010 Traffic*			2035 Traffic**		
I-65 Segment	AADT	Truck Volume	% Truck	AADT	Truck Volume	% Truck
County Line Rd to Southport Rd	98,921	16,670	17%	125,695	19,806	16%
Main St to County Line Rd	77,910	18,400	24%	97,182	22,442	23%
Whiteland Rd to Main St	63,150	15,870	25%	83,383	22,025	26%
SR-44 to Whiteland Rd	56,220	14,850	26%	68,559	18,457	27%

*Count Data (http://dotmaps.indot.in.gov/apps/trafficcounts/)
**Generated by ISTDM

The interchange of I-65 with Southport Road, illustrated in **Exhibit 4,** was determined to be the location with the highest traffic and emissions. This interchange has the highest truck and AADT volumes in the project study area, is the closest segment to the more urbanized area to the north, has the most traffic congestion in the corridor, and has residential development abutting the freeway. Based on the above characteristics, the ICG agreed that the geographic area for the analysis should focus on the Southport Road interchange including the signalized intersections at the ramps to I-65 and the segments of Southport Road immediately to the east and west.

Exhibit 4: Study Area for Quantitative Hot-spot Analysis



Maps from Google

A review of the selected project area (Southport Road interchange) did not identify any new or worsening point sources or facilities with significant numbers of idling diesel vehicles that would require individual consideration

Analysis Approach and Year(s)

Per ICG consultation and agreement, the 2017 project opening year was determined to be the year for the analysis. This decision was based on several key factors. $PM_{2.5}$ vehicle emissions are predominately generated by truck traffic. Average truck emissions are dropping rapidly as older vehicles are retired and replaced with vehicles meeting more stringent emission requirements. Previous analysis completed for INDOT confirmed this trend in truck emissions at the project level[2] and found it offset traffic growth by a sizable margin. Based on available ISTDM and MPO modeling, truck volumes within the study area are not increasing at a significant rate that would offset newer engine technology. As a result, the ICG agreed to model only 2017.

According to EPA guidance and per ICG concurrence, the hot-spot analysis focused on the project's build alternative. A hot-spot evaluation of the no-build analysis is not required to demonstrate conformity when the build alternative does not show a new or worsened violation of the NAAQS.

PM NAAQS Evaluated

The project is located in an area designated as nonattainment for the 1997 annual $PM_{2.5}$ NAAQS (15 micrograms per cubic meter $\mu g/m^3$). The area is currently attaining the 24-hour $PM_{2.5}$ NAAQS and 24-hour PM_{10} NAAQS.

Type of PM Emissions Modeled

The PM hot-spot analyses include only directly emitted $PM_{2.5}$ emissions. These include vehicle running and crankcase exhaust, brake wear, and tire wear emissions from on-road vehicles. Start and evaporative emissions are not a significant portion of the roadway emissions in the study area. Any non-running emissions are assumed to be included in the background concentrations. $PM_{2.5}$ precursors are not considered in PM hot-spot analyses, since precursors take time at the regional level to form into secondary PM.

Re-entrained road dust was not included because the State Implementation Plan does not identify that such emissions are a significant contributor to the $PM_{2.5}$ air quality in the nonattainment area. In addition, emissions from construction-related activities were not included because they are considered temporary as defined in 40 CFR 93.123(c)(5) (i.e. emissions that occur only during the construction phase and last five years or less at any individual site).

Models and Methods

The latest approved emissions model must be used in quantitative PM hot-spot analyses. The latest approved emission factor model is EPA's MOVES2010b. Ground-level air concentrations of $PM_{2.5}$ were estimated using AERMOD which is listed as one of the recommended air quality models for highway and intersection projects in the EPA quantitative PM hot-spot guidance. Based on previous EPA OTAQ recommendations, the roadway emissions were treated as an area source within the AERMOD model.

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[2] Air Quality Technical Report. $PM_{2.5}$ Quantitative Hot-spot Analysis I-69 Evansville to Indianapolis, Indiana: Section 5 Bloomington to Martinsville. Indiana Department of Transportation.

Project-Specific Data

The conformity rule requires that the latest planning assumptions (available at the time that the analysis begins) must be used in conformity determinations (40 CFR 93.110). In addition, the regulation states that hot-spot analysis assumptions must be consistent with those assumptions used in the regional emissions analysis for any inputs that are required for both analyses (40 CFR 93.123(c)(3)).

Traffic Data

In the absence of readily available traffic projections within the study corridor, a simple traffic forecasting effort was undertaken to support the air quality analysis. The forecasted 2017 traffic volumes were developed using runs of the Indianapolis MPO regional travel demand model (as conducted by the MPO) and traffic count/vehicle classification data from INDOT's Average Daily Traffic and Commercial Vehicles Interactive Map website[3]. Methods consistent with *NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*[4] were used to develop the forecasted volumes. Note that NCHRP Report 765 is an update to the long-standing NCHRP Report 255 which served as the definitive guidebook to the application of travel demand models for project evaluation analysis purposes. Where possible, conservative traffic assumptions were used to ensure the resulting air quality analysis would be conservative.

A traffic signal analysis of the intersections of the I-65 ramps at Southport Road was completed using the Synchro analysis tool and available 2010 traffic count data. The signal analysis was used to identify potential queue lengths and used for defining link types within the MOVES emission model. The percentage of trucks within the total traffic volume was based on INDOT traffic volume classification count data and was developed for each time period. Classification counts were not available on Southport Road, and in these cases the truck percentage was obtained from the travel demand model. The forecasted 2017 traffic volumes for the 3-hour AM, 3-Hour PM, and remaining off-peak periods are provided in **Attachment A**.

Roadway Elevation Data

To support the MOVES modeling of specific roadway links, geographic digital elevation files, obtained from the Indianapolis Mapping and Geographic Infrastructure System (*imagis*), and available Google Earth elevations were used to estimate a link-specific grade that impacted the resulting emission factors from MOVES. **Attachment B** summarizes the MOVES input data for each roadway link.

Emissions and Air Quality Data

This quantitative analysis uses local-specific data for both emissions and air quality modeling whenever possible, though default inputs may be appropriate in some cases. The Indianapolis MPO provided MOVES input files that were used for regional emissions analyses, including vehicle/fleet characterization data (age, fleet mix etc.), meteorological data, fuel, and control strategy parameters.

Hourly meteorological data is used for dispersion modeling and must be representative of the project area. The most recent available years (2006-2010) of off-site meteorological data prepared by IDEM was downloaded from the IDEM website (http://www.in.gov/idem/airquality/2376.htm). Surface

[3] http://dotmaps.indot.in.gov/apps/trafficcounts/

[4] http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_765.pdf

meteorological data is from the National Weather Service Site for Indianapolis, IN, while upper air meteorological data is from the Lincoln, IL station.

F. (Step 3) Estimate On-Road Vehicle Emissions

On-road vehicle emissions were estimated using the MOVES emission factor model. As discussed in the previous section, the MOVES inputs are consistent with recent SIP and conformity analyses conducted by the Indianapolis MPO. The modeling undertaken for this project includes traffic estimates subdivided into light duty vehicles (autos) and trucks. These values were allocated into the various MOVES source-type (vehicle) classifications by applying vehicle distributions used in the development of the on-road mobile source emissions inventory found in the SIP.

The MOVES input traffic information relies on link-specific data, a distinction that is particularly important when employing it for project level analysis. A link file includes the vehicle volume, average speed, facility type, and grade. The PM emissions vary by time of day and time of year. Volume and speed data for each link were provided by the traffic analysts for AM peak, PM peak, and daily average traffic conditions.

MOVES was run for four weekday time periods (AM peak, midday, PM peak, and overnight) for four different months (January, April, July, and October) to account for different climate conditions throughout the year. The AM and PM peak time periods were run with peak-hour traffic activity while the midday and overnight time periods were run with average-hour activity. Time periods were represented by the following hours:

- 6 AM was used to represent the AM time period (6 AM – 9 AM)
- 12 PM was used to represent the midday time period (9 AM – 3 PM)
- 6 PM was used to represent PM peak time period (3 PM – 6 PM)
- 12 AM was used to represent the overnight time period (6 PM – 6 AM)

The results of the four hours were extrapolated to cover the entire day. The MOVES2AERMOD tool downloaded from the EPA website was utilized to post-process MOVES outputs for generating the "EMISFACT" portion of an AERMOD input file. The emission rates as input to AERMOD are in units of grams per second per square meter. **Attachment C** summarizes MOVES emission rates by four representative time periods for each of the four representative months. A checklist summarizing MOVES "Run Spec" and input assumptions is shown in **Attachment D**.

G. (Step 4) Road Dust, Construction, and Additional Sources

Road dust emissions were not included in the analysis as described in Step 2. Construction emissions were not included as the period of construction for this segment will be for less than five years. No additional sources of $PM_{2.5}$ emissions were included in this analysis. It is assumed that $PM_{2.5}$ concentrations due to any nearby emissions sources are included in the ambient monitor values that are used as background concentrations. In addition, this project is not expected to result in changes to emissions from existing nearby sources or support any new facilities that would impact localized $PM_{2.5}$ levels.

H. (Step 5) Air-Quality Model, Data Inputs, and Receptors

The following provides an overview of the air quality modeling undertaken including the assumptions used in EPA's AERMOD model that was used to estimate concentrations of $PM_{2.5.}$ The AERMOD model requires the determination of the emission sources (e.g. the roadway) and the locations to measure air quality concentrations (e.g. the receptors). **Exhibit 5** illustrates the extents used to define the source and receptor locations.

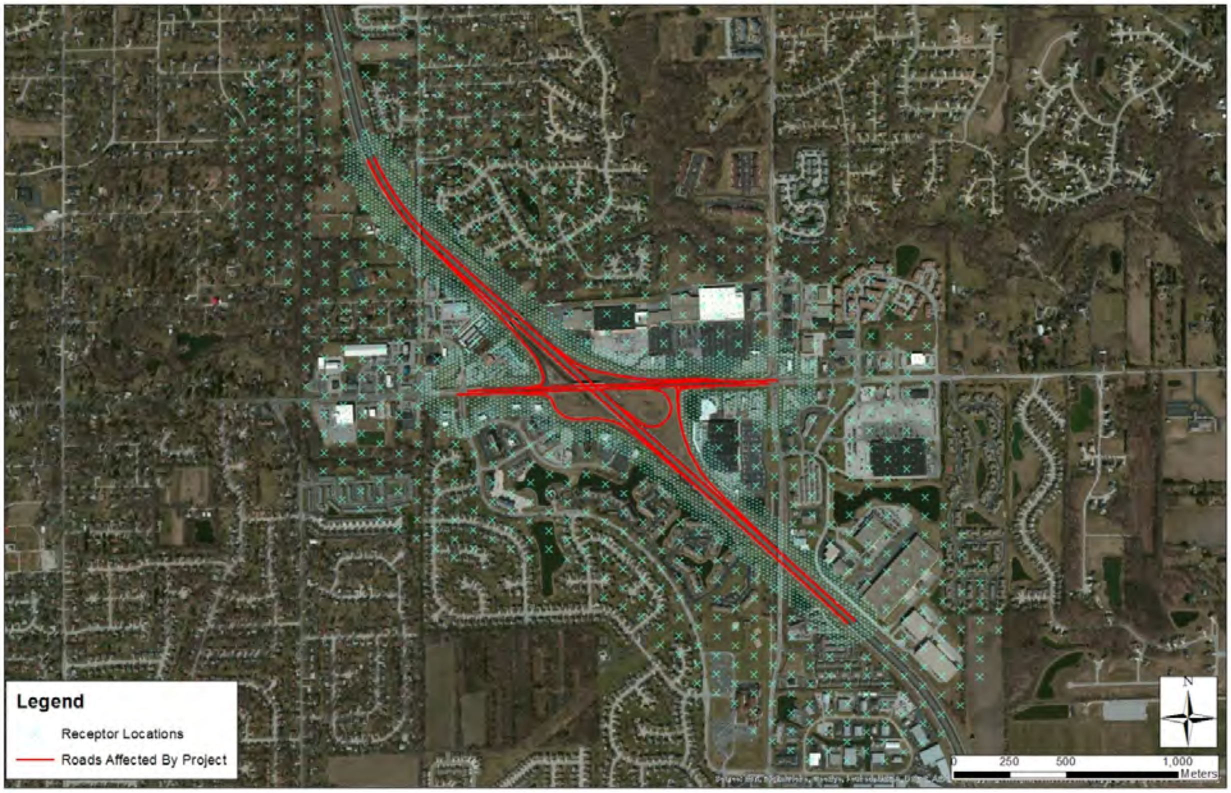
Exhibit 5: Extent of Emissions and Air Quality Modeling

Defined areas were used to delineate the emission sources. Using GIS software, polygons were created having the same roadway segmentation as found in the traffic forecasting and MOVES modeling, with the width set to the width of the travel lanes.

As recommended in the EPA PM hot-spot guidance, receptors were placed in order to estimate the highest concentrations of $PM_{2.5}$ and to determine any possible violations of the NAAQS. Areas with higher concentrations of $PM_{2.5}$ are expected nearest the interchange and along the I-65 right–of-way. An area within 5m of the edge of all roadways was excluded as were medians and other areas to which the public would not have access.

GIS software was used to define an area within 80 meters of the roadway edges. Within this area (but outside the excluded areas) receptors were located in a 15m diagonal grid formation. A second area was then defined between 80m and 500m of the edge of the roadways. Within this area, receptors were located in 75m diagonal grid formation. The extensive grid of receptors is used to evaluate the impact of the roadway emissions within the study area. **Exhibit 6** illustrates the extent area for receptor locations.

Exhibit 6: Modeled Receptor Locations



I. (Step 6) Background Concentrations from Nearby and Other Sources

The determination of background emissions was based on readings available from monitors in the region. No monitor is located immediately within the study area. Nearby monitors are shown in **Exhibit 7**.

Key references used in determining the appropriate background concentration levels to use include:

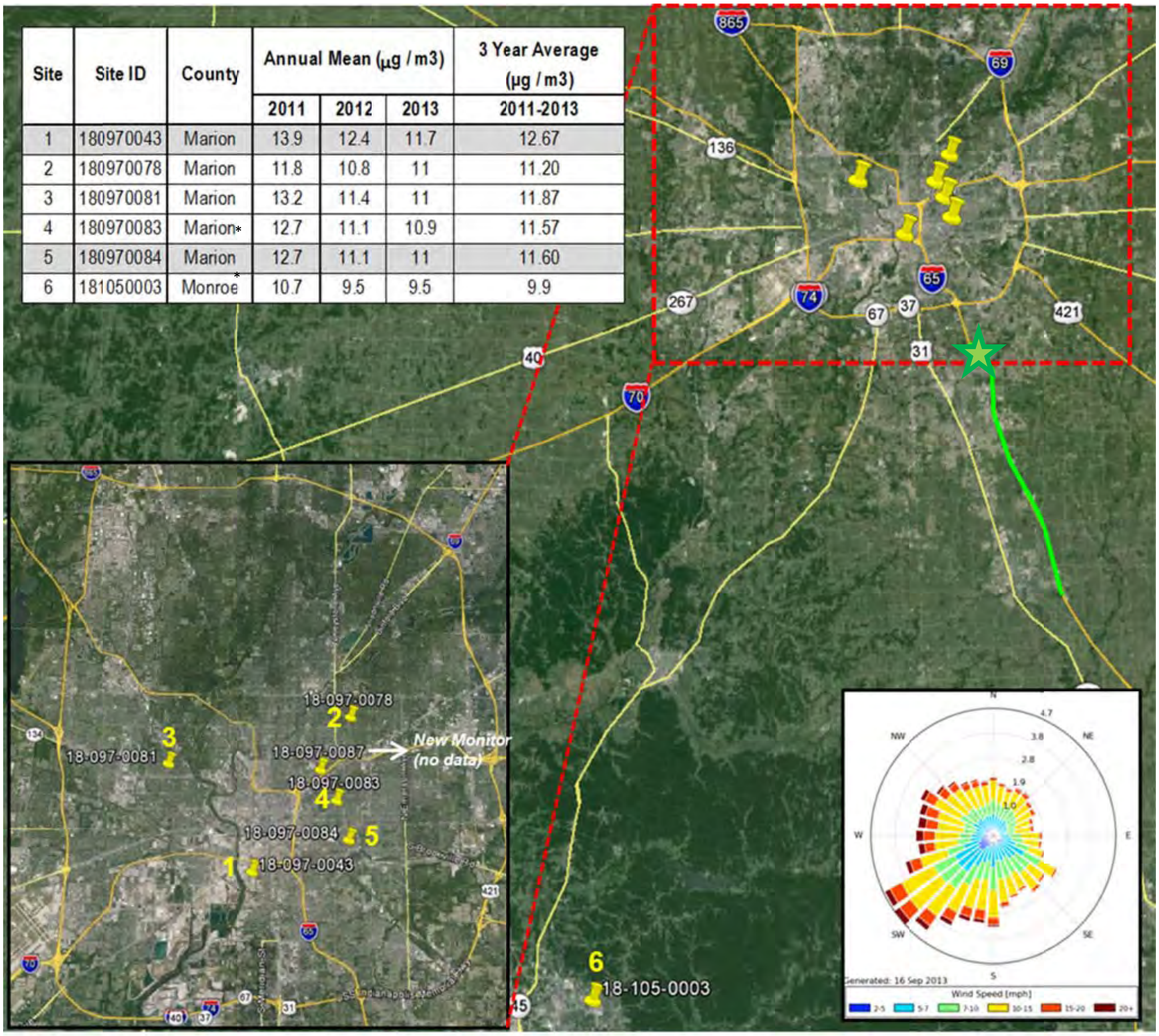
- The EPA PM Hot-spot guidance (Section 8)
- Conformity rule, Sections 93.105(c)(1)(i) and 93.123(c)
- 40 CFR Part 51, Appendix W, Section 8.2.1 and 8.2.3

Monitor air quality data from EPA's Air Quality System was obtained from the EPA's AirData website (http://www.epa.gov/airdata/). Factors in choosing the monitors included:

- Distance of monitor from project area
- Wind patterns between monitor from project area
- Similar characteristics between the monitor location and project area

Based on ICG discussions, no single ambient monitor was found to be sufficiently representative of the project area. The ICG chose to interpolate background concentrations between several monitors as described in the EPA PM Hot-Spot Guidance. Specifically, the weighted average interpolation methodology was used. This methodology was chosen because it placed greater weight on nearby monitors by using the inverse distance between the project site and the monitor to weight each monitor's 3-year average (2011-2013) value. The ICG agreed that a value of 11.27 µg/m^3 reasonably reflected the background concentration in this region. This value, as illustrated in **Exhibit 8**, represents the averages of the two closest monitors to the project location (site numbers 2 and 4 located in Marion County) and the Bloomington, IN monitor, site number 6.

Exhibit 7: Monitor Locations and Average Annual $PM_{2.5}$ Levels Reported



Site	Site ID	County	Annual Mean (µg / m3)			3 Year Average (µg / m3)
			2011	2012	2013	2011-2013
1	180970043	Marion	13.9	12.4	11.7	12.67
2	180970078	Marion	11.8	10.8	11	11.20
3	180970081	Marion	13.2	11.4	11	11.87
4	180970083	Marion*	12.7	11.1	10.9	11.57
5	180970084	Marion	12.7	11.1	11	11.60
6	181050003	Monroe*	10.7	9.5	9.5	9.9

*Per IDEM, monitor sites 1 and 5 are considered "source specific," and are not appropriate for NAAQS comparison

Exhibit 8: Monitor Locations and Average Annual $PM_{2.5}$ Levels Reported

Site Number	Site ID	Distance from Project Area	Monitor Value 3-Year Avg. (µg/m3)	Weight	Weighted Monitor Value
2	180970078	10.12	11.20	0.39	4.39
4	180970083	7.73	11.57	0.51	5.93
6	181050003	41.39	9.90	0.10	0.95
Inverse Distance Weighted Average Concentration µg/m³					*11.27*

The Monroe County monitor was selected because prevailing winds are from the southwest during most of the year (http://iclimate.org/narrative.asp). The ICG agreed that this was a key component in determining the project area's background emissions, but noted that the monitor is located at a greater distance than the monitors located in Marion County. To ensure a conservative and accurate background concentration, the closest monitors to the project area were also included in the calculations as their 3-year values were higher than the Monroe County monitor.

In addition, these values are conservative because it is expected that ambient $PM_{2.5}$ concentrations will be lower in future years as a result of the State Implementation Plan and the general trend in declining vehicle emissions due to technological advances. This value was added to the AERMOD modeled receptor values to yield a design values for comparison to the NAAQS.

J. (Step 7) Calculate Design Values and Determine Conformity

The previous steps of the PM hot-spot analysis were combined to determine design values that were compared to the NAAQS for each analysis year. The annual $PM_{2.5}$ design values are defined as the average of three consecutive years' annual averages, each estimated using equally-weighted quarterly averages. This NAAQS is met when the three-year average concentration is less than or equal to the 1997 annual $PM_{2.5}$ NAAQS.

AERMOD was run to provide the annual average $PM_{2.5}$ concentrations at each receptor. For the receptor with the maximum modeled concentration (in each analysis year), the following steps were used to determine the design value, as outlined in EPA's guidance.

1. Obtain the average annual concentration for the receptor with the maximum modeled concentration from AERMOD output.
2. Add the average annual background concentration (11.27 µg/m³ as described in Step 6) to the average annual modeled concentration to determine the total average annual concentration.
3. **Exhibit 9** summarizes the design values that correspond to the receptor with the maximum modeled concentration for each analysis year. All design values for the maximum receptor location are below the 1997 annual $PM_{2.5}$ NAAQS of 15.0 µg/m³.
4. It is implied that the design value for all other receptors within the model domain are equal to, or lower than, the values in **Exhibit 9**, and therefore, are also below the NAAQS.

Exhibit 9: Estimated 2017 Design Value

Analysis Year	Background Concentration (µg/m³)	AERMOD Modeling Results* (µg/m³)	Design Value (µg/m³) (rounded to one decimal per EPA Guidance)
2017	11.27	0.76	12.0

Notes: Modeling results are for the receptors with the maximum concentration.
1997 annual $PM_{2.5}$ NAAQS is 15 µg/m³
µg/m³ = micrograms per cubic meter

Exhibit 10 illustrates the top 10 receptors with the highest concentrations from the modeling results. The project does not create a violation of the 1997 annual $PM_{2.5}$ NAAQS or worsen an existing exceedance of the NAAQS, which supports the project level conformity determination. **Attachment E** summarizes the AERMOD modeling results for top 10 receptors with the highest concentrations and the receptor with lowest concentration for 2017.

Exhibit 10: Receptors with Highest Concentrations

K. (Step 8) Mitigation or Control Measures

No mitigation of air quality effects was proposed. All modeled annual $PM_{2.5}$ concentrations are below the NAAQS.

L. (Step 9) Document the PM Hot-Spot Analysis

This report documents the PM hot-spot analysis. Because of the large volume of input and output files, they are not included in this report and are available electronically upon request.

M. Public Involvement

The conformity rule requires agencies completing project-level conformity determinations to establish a proactive public involvement process that provides opportunity for public review and comment (40 CFR 93.105(e)). The technical report was advertised in the <Provide Newspaper> on <Provide Date>. A <Comment period length> comment period was offered, which concluded on <Provide Date>. Copies of the public notices and affidavits are provided in **Attachment F**. No comments were received during the comment period.

N. Conclusion

This technical report has provided a quantitative $PM_{2.5}$ hot-spot analysis for the I-65, SR44 to Southport Road project in Indiana. The interagency consultation process played an integral role in defining the need, methodology and assumptions for the analysis. The air quality analysis included modeling techniques to estimate project-specific emission factors from vehicle exhaust and local $PM_{2.5}$ concentrations due to project operation. Emissions and dispersion modeling techniques were consistent with the EPA quantitative PM hot-spot analysis guidance, "*Transportation Conformity Guidance for Quantitative Hot-spot Analysis in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*" (USEPA, 2013) that was updated in November 2013.

The analysis had demonstrated transportation conformity for the project by determining that future design value concentrations for the 2017 analysis year will be lower than the 1997 annual $PM_{2.5}$ NAAQS of 15.0 $\mu g/m^3$. As a result, the project does not create a violation of the 1997 annual $PM_{2.5}$ NAAQS, worsen an existing violation of the NAAQS, or delay timely attainment of the NAAQS and interim milestones, which meets 40 CRF 93.116 and 93.123 and supports the project level conformity determination.

References

- United States Environmental Protection Agency (USEPA). 2013. "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas."
- United States Environmental Protection Agency (USEPA) and United States Department of Transportation. 2012. "Completing Quantitative PM Hot-spot Analysis: 3 Day Course"

Attachments

- Attachment A: Traffic Volume Forecasts
- Attachment B: MOVES Link Data Input Files
- Attachment C: MOVES Outputs (Emission Rates for AERMOD Modeling)
- Attachment D: MOVES and AERMOD Input Data Assumptions and Parameters
- Attachment E: AERMOD Outputs for Top 10 and Lowest Receptors
- Attachment F: Public Comment Notices and Affidavits

Attachment A:
Traffic Volume Forecasts I-65 SR44 at Southport Road

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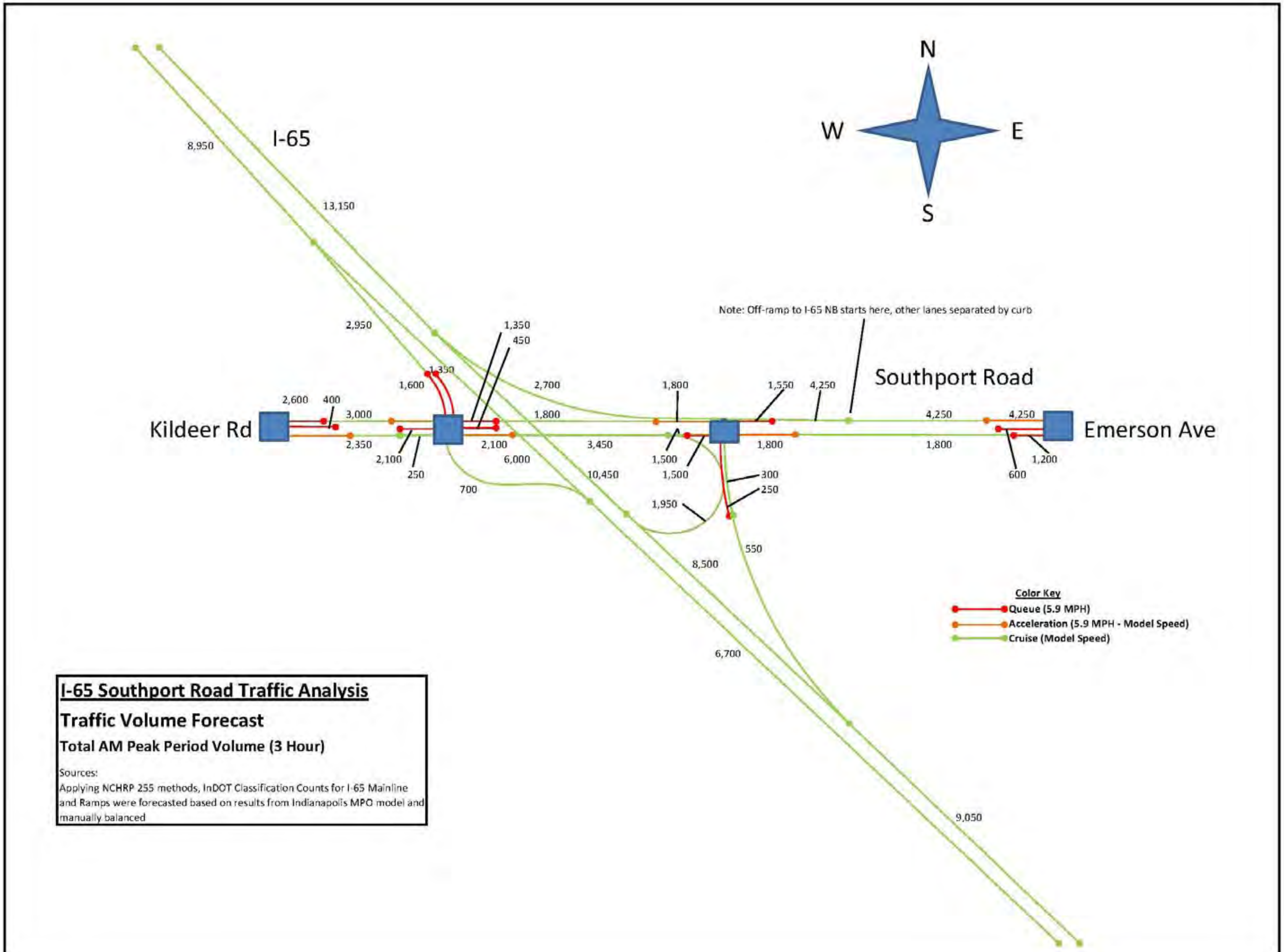
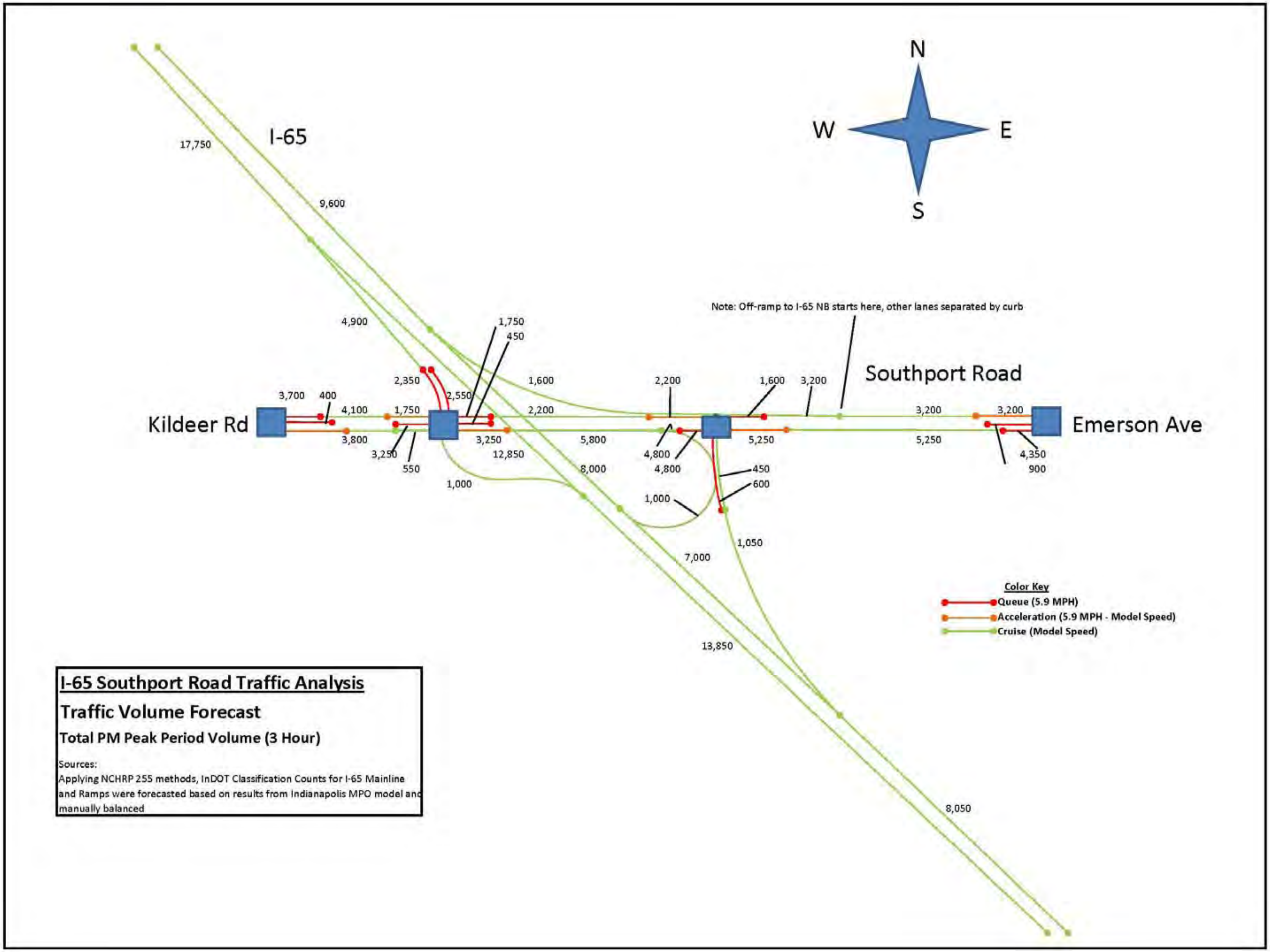


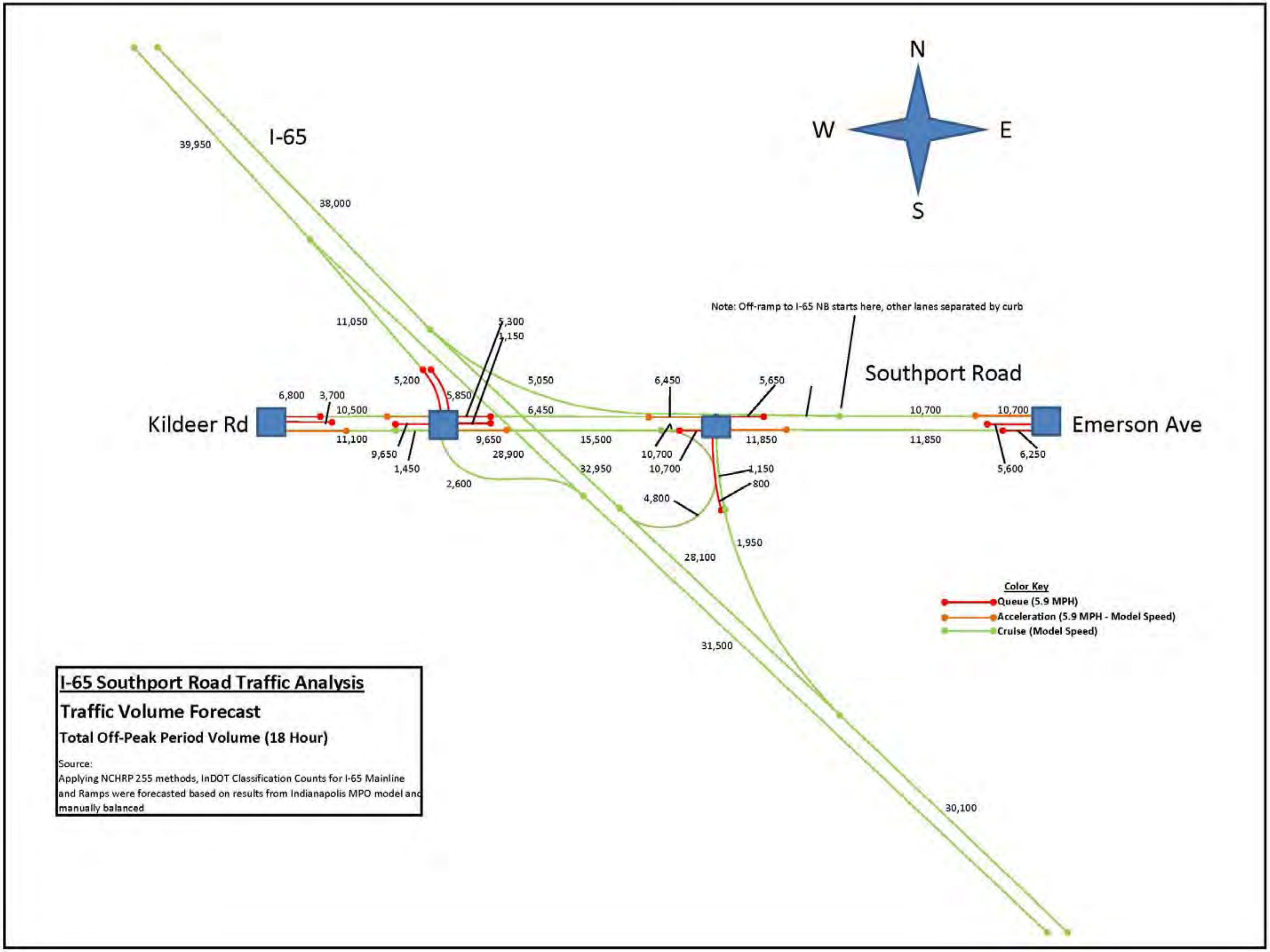
I-65 Southport Road Traffic Analysis

Traffic Volume Forecast

Total AM Peak Period Volume (3 Hour)

Sources:
Applying NCHRP 255 methods, InDOT Classification Counts for I-65 Mainline and Ramps were forecasted based on results from Indianapolis MPO model and manually balanced


N
W
E
S
I-65
17,750
9,600
4,900
1,750
450
2,350
2,550
1,600
2,200
1,600
3,200
Note: Off-ramp to I-65 NB starts here, other lanes separated by curb
Southport Road
3,700
400
4,100
1,750
2,200
3,200
3,200
Kildeer Rd
Emerson Ave
3,800
3,250
3,250
5,800
5,250
5,250
12,850
550
8,000
4,800
4,800
4,350
900
450
600
1,000
1,000
1,050
7,000
13,850
8,050
Color Key
Queue (5.9 MPH)
Acceleration (5.9 MPH - Model Speed)
Cruise (Model Speed)
I-65 Southport Road Traffic Analysis
Traffic Volume Forecast
Total PM Peak Period Volume (3 Hour)
Sources:
Applying NCHRP 255 methods, InDOT Classification Counts for I-65 Mainline and Ramps were forecasted based on results from Indianapolis MPO model and manually balanced


N
W
E
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I-65
39,950
38,000
11,050
5,300
1,150
5,200
5,850
5,050
6,450
5,650
Note: Off-ramp to I-65 NB starts here, other lanes separated by curb
Southport Road
6,800
3,700
10,500
6,450
10,700
10,700
Kildeer Rd
Emerson Ave
11,100
9,650
15,500
11,850
11,850
9,650
28,900
10,700
6,250
1,450
32,950
10,700
1,150
5,600
2,600
800
4,800
1,950
28,100
31,500
30,100
Color Key
Queue (5.9 MPH)
Acceleration (5.9 MPH - Model Speed)
Cruise (Model Speed)
I-65 Southport Road Traffic Analysis
Traffic Volume Forecast
Total Off-Peak Period Volume (18 Hour)
Source:
Applying NCHRP 255 methods, InDOT Classification Counts for I-65 Mainline and Ramps were forecasted based on results from Indianapolis MPO model and manually balanced

Attachment B:
MOVES Link Data Input Files

MOVES Emissions Analysis Inputs
2017 Daily (For Hours 12 AM and 12 PM Runs)

Link ID	Roadway Type ID	Link Length (Miles)	Link Volume (veh/hour)	Link Avg Speed (MPH)	Link Description	Link Avg. Grade
1	4	0.368	2777	56.50	I-65 SB N of SP Off-Ramp	-0.01
2	4	0.222	788	52.25	I-65 SB Off Ramp	-0.01
3	4	0.128	1990	57.00	I-65 SB S of SP off-ramp	-0.01
4	4	0.273	1990	57.00	I-65 SB S of SP off-ramp	0.01
5	4	0.120	179	25.00	On Ramp to I-65 SB	0.01
6	4	0.086	179	25.00	On Ramp to I-65 SB	-0.01
7	4	0.064	179	25.00	On Ramp to I-65 SB	0.00
8	4	0.596	2169	57.00	I-65 SB S of SP	0.01
9	4	0.360	1967	56.75	I-65 NB S of SP	0.00
10	4	0.306	148	35.00	I-65 NB Off Ramp	0.00
11	4	0.206	1819	56.75	I-65 NB N of Off Ramp	-0.01
12	4	0.078	323	25.00	EB Loop to I65 NB	0.00
13	4	0.066	323	25.00	EB Loop to I65 NB	-0.04
14	4	0.054	323	25.00	EB Loop to I65 NB	-0.01
15	4	0.040	323	25.00	EB Loop to I65 NB	-0.02
16	4	0.144	2142	56.75	I-65 NB N of Loop on Ramp	-0.02
17	4	0.063	2142	56.75	I-65 NB N of Loop on Ramp	-0.01
18	4	0.157	390	45.00	WB to NB I-65 Ramp	-0.04
19	4	0.159	390	45.00	WB to NB I-65 Ramp	-0.01
20	4	0.597	2531	56.88	WB to NB I-65 Ramp	0.01
21	5	0.125	733	36.00	WB SP West of I-65	0.00
22	5	0.039	546	5.90	WB @ Kildeer RT/TH Queue	0.00
23	5	0.031	188	5.90	WB @ Kildeer LT Queue	-0.02
24	5	0.093	719	15.05	EB @ Kildeer Accel	0.04
25	5	0.095	719	36.00	EB SP West of I-65	0.00
26	5	0.077	435	35.63	WB SP East of SB I-65 Ramps	-0.03
27	5	0.078	350	5.90	WB @ SB I-65 Ramps TH Queue	-0.02
28	5	0.127	85	5.90	WB @ SB I-65 Ramps LT Queue	-0.01
29	5	0.060	419	14.80	WB @ SB I-65 Ramps Accel	-0.02
30	5	0.086	94	25.00	EB @ SB I-65 Ramps RT merge	0.02
31	5	0.139	625	5.90	EB @ SB I-65 Ramps TH Queue	0.02
32	5	0.043	681	15.05	EB @ SB I-65 Ramps Accel	0.03
33	5	0.127	1031	35.75	EB SP East of SB I-65 Ramps	0.00
34	4	0.047	381	5.90	SB @ SB I-65 Ramps RT/TH Queue	0.07
35	4	0.065	381	5.90	SB @ SB I-65 Ramps RT/TH Queue	0.03
36	4	0.046	406	5.90	SB @ SB I-65 Ramps LT Queue	0.00
37	4	0.047	406	5.90	SB @ SB I-65 Ramps LT Queue	0.06
38	5	0.009	756	35.63	WB West of NB I-65 Offramp	0.00
39	5	0.035	367	5.90	WB @ NB I-65 Offramp TH Queue	0.00
40	5	0.100	435	14.80	WB @ NB I-65 Offramp Accel	0.00
41	5	0.015	435	14.80	WB @ NB I-65 Offramp Accel	0.00
42	5	0.079	708	35.75	EB East of I-65 NB Loop	0.00
43	5	0.019	708	5.90	EB @ NB I-65 Offramp TH Queue	0.00
44	5	0.063	740	14.93	EB @ NB I-65 Offramp Accel	0.00
45	4	0.033	79	35.00	NB @ NB I-65 Offramp RT	0.03
46	4	0.040	69	5.90	NB @ NB I-65 Offramp LT Queue	0.03
47	5	0.086	756	14.80	WB @ Emerson Accel	0.00
48	5	0.079	756	35.63	WB SP East of I-65	0.00
49	5	0.125	788	35.75	EB SP East of I-65	0.00
50	5	0.032	492	5.90	EB @ Emerson RT/TH Queue	0.01
51	5	0.041	296	5.90	EB @ Emerson LT Queue	0.00

MOVES Emissions Analysis Inputs
2017 AM Peak Period (For Hour 6 AM Run)

Link ID	Roadway Type ID	Link Length (Miles)	Link Volume (veh/hour)	Link Avg Speed (MPH)	Link Description	Link Avg. Grade
1	4	0.368	2983	57.00	I-65 SB N of SP Off-Ramp	-0.01
2	4	0.222	983	35.00	I-65 SB Off Ramp	-0.01
3	4	0.128	2000	56.00	I-65 SB S of SP off-ramp	-0.01
4	4	0.273	2000	56.00	I-65 SB S of SP off-ramp	0.01
5	4	0.120	233	25.00	On Ramp to I-65 SB	0.01
6	4	0.086	233	25.00	On Ramp to I-65 SB	-0.01
7	4	0.064	233	25.00	On Ramp to I-65 SB	0.00
8	4	0.596	2233	56.00	I-65 SB S of SP	0.01
9	4	0.360	3017	57.00	I-65 NB S of SP	0.00
10	4	0.306	183	35.00	I-65 NB Off Ramp	0.00
11	4	0.206	2833	57.00	I-65 NB N of Off Ramp	-0.01
12	4	0.078	650	25.00	EB Loop to I65 NB	0.00
13	4	0.066	650	25.00	EB Loop to I65 NB	-0.04
14	4	0.054	650	25.00	EB Loop to I65 NB	-0.01
15	4	0.040	650	25.00	EB Loop to I65 NB	-0.02
16	4	0.144	3483	57.00	I-65 NB N of Loop on Ramp	-0.02
17	4	0.063	3483	57.00	I-65 NB N of Loop on Ramp	-0.01
18	4	0.157	900	45.00	WB to NB I-65 Ramp	-0.04
19	4	0.159	900	45.00	WB to NB I-65 Ramp	-0.01
20	4	0.597	4383	55.00	WB to NB I-65 Ramp	0.01
21	5	0.125	1000	36.00	WB SP West of I-65	0.00
22	5	0.039	867	5.90	WB @ Kildeer RT/TH Queue	0.00
23	5	0.031	133	5.90	WB @ Kildeer LT Queue	-0.02
24	5	0.093	783	15.05	EB @ Kildeer Accel	0.04
25	5	0.095	783	36.00	EB SP West of I-65	0.00
26	5	0.077	600	36.00	WB SP East of SB I-65 Ramps	-0.03
27	5	0.078	450	5.90	WB @ SB I-65 Ramps TH Queue	-0.02
28	5	0.127	150	5.90	WB @ SB I-65 Ramps LT Queue	-0.01
29	5	0.060	1000	15.05	WB @ SB I-65 Ramps Accel	-0.02
30	5	0.086	83	25.00	EB @ SB I-65 Ramps RT merge	0.02
31	5	0.139	700	5.90	EB @ SB I-65 Ramps TH Queue	0.02
32	5	0.043	1150	15.05	EB @ SB I-65 Ramps Accel	0.03
33	5	0.127	1150	34.00	EB SP East of SB I-65 Ramps	0.00
34	4	0.047	533	5.90	SB @ SB I-65 Ramps RT/TH Queue	0.07
35	4	0.065	533	5.90	SB @ SB I-65 Ramps RT/TH Queue	0.03
36	4	0.046	450	5.90	SB @ SB I-65 Ramps LT Queue	0.00
37	4	0.047	450	5.90	SB @ SB I-65 Ramps LT Queue	0.06
38	5	0.009	1417	36.00	WB West of NB I-65 Offramp	0.00
39	5	0.035	517	5.90	WB @ NB I-65 Offramp TH Queue	0.00
40	5	0.100	600	15.05	WB @ NB I-65 Offramp Accel	0.00
41	5	0.015	600	15.05	WB @ NB I-65 Offramp Accel	0.00
42	5	0.079	500	34.00	EB East of I-65 NB Loop	0.00
43	5	0.019	500	5.90	EB @ NB I-65 Offramp TH Queue	0.00
44	5	0.063	600	14.05	EB @ NB I-65 Offramp Accel	0.00
45	4	0.033	100	35.00	NB @ NB I-65 Offramp RT	0.03
46	4	0.040	83	5.90	NB @ NB I-65 Offramp LT Queue	0.03
47	5	0.086	1417	15.05	WB @ Emerson Accel	0.00
48	5	0.079	1417	36.00	WB SP East of I-65	0.00
49	5	0.125	600	34.00	EB SP East of I-65	0.00
50	5	0.032	400	5.90	EB @ Emerson RT/TH Queue	0.01
51	5	0.041	200	5.90	EB @ Emerson LT Queue	0.00

MOVES Emissions Analysis Inputs
2017 PM Peak Period (For Hour 6 PM Run)

Link ID	Roadway Type ID	LinkLength (Miles)	LinkVolume (veh/hour)	Link AvgSpeed	Link Description	Link Avg. Grade
1	4	0.368	5917	53.00	I-65 SB N of SP Off-Ramp	-0.01
2	4	0.222	1633	35.00	I-65 SB Off Ramp	-0.01
3	4	0.128	4283	58.00	I-65 SB S of SP off-ramp	-0.01
4	4	0.273	4283	58.00	I-65 SB S of SP off-ramp	0.01
5	4	0.120	333	25.00	On Ramp to I-65 SB	0.01
6	4	0.086	333	25.00	On Ramp to I-65 SB	-0.01
7	4	0.064	333	25.00	On Ramp to I-65 SB	0.00
8	4	0.596	4617	58.00	I-65 SB S of SP	0.01
9	4	0.360	2683	55.00	I-65 NB S of SP	0.00
10	4	0.306	350	35.00	I-65 NB Off Ramp	0.00
11	4	0.206	2333	55.00	I-65 NB N of Off Ramp	-0.01
12	4	0.078	333	25.00	EB Loop to I65 NB	0.00
13	4	0.066	333	25.00	EB Loop to I65 NB	-0.04
14	4	0.054	333	25.00	EB Loop to I65 NB	-0.01
15	4	0.040	333	25.00	EB Loop to I65 NB	-0.02
16	4	0.144	2667	55.00	I-65 NB N of Loop on Ramp	-0.02
17	4	0.063	2667	55.00	I-65 NB N of Loop on Ramp	-0.01
18	4	0.157	533	45.00	WB to NB I-65 Ramp	-0.04
19	4	0.159	533	45.00	WB to NB I-65 Ramp	-0.01
20	4	0.597	3200	58.00	WB to NB I-65 Ramp	0.01
21	5	0.125	1367	36.00	WB SP West of I-65	0.00
22	5	0.039	1233	5.90	WB @ Kildeer RT/TH Queue	0.00
23	5	0.031	133	5.90	WB @ Kildeer LT Queue	-0.02
24	5	0.093	1267	15.05	EB @ Kildeer Accel	0.04
25	5	0.095	1267	36.00	EB SP West of I-65	0.00
26	5	0.077	733	33.00	WB SP East of SB I-65 Ramps	-0.03
27	5	0.078	583	5.90	WB @ SB I-65 Ramps TH Queue	-0.02
28	5	0.127	150	5.90	WB @ SB I-65 Ramps LT Queue	-0.01
29	5	0.060	583	13.05	WB @ SB I-65 Ramps Accel	-0.02
30	5	0.086	183	25.00	EB @ SB I-65 Ramps RT merge	0.02
31	5	0.139	1083	5.90	EB @ SB I-65 Ramps TH Queue	0.02
32	5	0.043	1083	15.05	EB @ SB I-65 Ramps Accel	0.03
33	5	0.127	1933	36.00	EB SP East of SB I-65 Ramps	0.00
34	4	0.047	783	5.90	SB @ SB I-65 Ramps RT/TH Queue	0.07
35	4	0.065	783	5.90	SB @ SB I-65 Ramps RT/TH Queue	0.03
36	4	0.046	850	5.90	SB @ SB I-65 Ramps LT Queue	0.00
37	4	0.047	850	5.90	SB @ SB I-65 Ramps LT Queue	0.06
38	5	0.009	1067	33.00	WB West of NB I-65 Offramp	0.00
39	5	0.035	533	5.90	WB @ NB I-65 Offramp TH Queue	0.00
40	5	0.100	733	13.05	WB @ NB I-65 Offramp Accel	0.00
41	6	0.015	733	13.05	WB @ NB I-65 Offramp Accel	0.00
42	5	0.079	1600	36.00	EB East of I-65 NB Loop	0.00
43	5	0.019	1600	5.90	EB @ NB I-65 Offramp TH Queue	0.00
44	5	0.063	1750	15.05	EB @ NB I-65 Offramp Accel	0.00
45	4	0.033	150	35.00	NB @ NB I-65 Offramp RT	0.03
46	4	0.040	200	5.90	NB @ NB I-65 Offramp LT Queue	0.03
47	5	0.086	1067	13.05	WB @ Emerson Accel	0.00
48	5	0.079	1067	33.00	WB SP East of I-65	0.00
49	5	0.125	1750	36.00	EB SP East of I-65	0.00
50	5	0.032	1450	5.90	EB @ Emerson RT/TH Queue	0.01
51	5	0.041	300	5.90	EB @ Emerson LT Queue	0.00

Attachment C:
MOVES Outputs (Emission Rates for AERMOD Modeling)

<Data Outputs Begin on Following Page>

2017 MOVES Emission Rates (grams/second/meter^2)
January

Month	Link ID	AM	MD	PM	NT
January	1	1.72108E-07	1.08798E-07	2.6431E-07	1.37163E-07
January	2	1.6515E-07	9.92922E-08	2.48164E-07	1.27712E-07
January	3	1.3639E-07	9.09692E-08	2.138E-07	1.1479E-07
January	4	1.33513E-07	8.90047E-08	2.09164E-07	1.12312E-07
January	5	7.13109E-08	4.45005E-08	8.74632E-08	5.25359E-08
January	6	5.56693E-08	3.47392E-08	6.82717E-08	4.10111E-08
January	7	5.52951E-08	3.45109E-08	6.78239E-08	4.07373E-08
January	8	1.49972E-07	9.76044E-08	2.26844E-07	1.23164E-07
January	9	1.73741E-07	7.63686E-08	1.1702E-07	9.62971E-08
January	10	3.94516E-08	2.69717E-08	7.45809E-08	3.30384E-08
January	11	3.14072E-06	1.35828E-06	1.95875E-06	1.71275E-06
January	12	2.30381E-07	8.90661E-08	9.4542E-08	1.05583E-07
January	13	2.08528E-07	8.07279E-08	8.56718E-08	9.56126E-08
January	14	2.39303E-07	9.25026E-08	9.81895E-08	1.09669E-07
January	15	2.34494E-07	9.0786E-08	9.63481E-08	1.07519E-07
January	16	2.21776E-07	9.18985E-08	1.28599E-07	1.15876E-07
January	17	2.05594E-07	8.51915E-08	1.19224E-07	1.0743E-07
January	18	2.441E-07	7.39151E-08	1.05621E-07	9.31977E-08
January	19	2.64802E-07	8.01292E-08	1.14511E-07	1.01079E-07
January	20	2.63289E-07	1.01068E-07	1.39563E-07	1.27458E-07
January	21	1.2569E-07	6.97442E-08	1.30976E-07	8.55568E-08
January	22	8.92778E-07	4.48971E-07	1.02008E-06	5.28571E-07
January	23	1.03824E-07	1.17561E-07	8.34664E-08	1.38351E-07
January	24	1.48937E-07	1.05624E-07	1.8794E-07	1.27801E-07
January	25	9.42959E-08	6.59079E-08	1.17312E-07	8.06411E-08
January	26	7.27658E-08	4.17851E-08	8.03457E-08	5.0889E-08
January	27	1.2872E-07	8.23811E-08	1.44895E-07	9.66352E-08
January	28	1.12588E-07	5.11981E-08	9.56113E-08	6.08571E-08
January	29	1.90094E-07	6.17036E-08	9.14361E-08	7.4723E-08
January	30	3.18853E-08	2.78921E-08	5.77165E-08	3.42787E-08
January	31	5.7837E-07	4.14358E-07	7.23566E-07	4.87139E-07
January	32	2.30544E-07	1.0072E-07	1.59264E-07	1.21398E-07
January	33	1.36786E-07	8.60681E-08	1.59825E-07	1.04723E-07
January	34	2.02949E-07	1.26301E-07	2.82285E-07	1.46999E-07
January	35	2.27406E-07	1.41558E-07	3.16375E-07	1.64726E-07
January	36	1.55474E-07	1.22553E-07	2.78165E-07	1.42542E-07
January	37	1.66329E-07	1.31023E-07	2.97475E-07	1.52507E-07
January	38	1.66612E-07	7.01284E-08	1.13366E-07	8.5387E-08
January	39	1.58004E-07	9.2108E-08	1.4154E-07	1.08084E-07
January	40	1.10163E-07	6.39001E-08	1.20643E-07	7.70235E-08
January	41	1.28416E-07	7.44881E-08	1.03494E-07	8.97861E-08
January	42	6.49807E-08	6.43716E-08	1.44545E-07	7.82966E-08
January	43	1.60766E-07	1.73839E-07	3.91869E-07	2.03842E-07
January	44	1.18077E-07	1.03721E-07	2.44193E-07	1.24903E-07
January	45	2.34124E-08	1.54903E-08	3.47433E-08	1.89828E-08
January	46	5.3897E-08	4.02947E-08	1.32955E-07	4.68757E-08
January	47	2.6252E-07	1.11685E-07	1.77203E-07	1.34599E-07
January	48	1.8606E-07	7.83138E-08	1.26599E-07	9.53534E-08
January	49	4.95328E-08	4.51731E-08	9.95846E-08	5.49468E-08
January	50	8.42487E-08	7.86469E-08	2.31007E-07	9.21989E-08
January	51	1.0409E-07	1.17051E-07	1.181E-07	1.37282E-07

2017 MOVES Emission Rates (grams/second/meter^2)
April

Month	Link ID	AM	MD	PM	NT
April	1	1.02583E-07	7.04398E-08	1.71192E-07	8.40898E-08
April	2	1.07366E-07	6.08595E-08	1.69707E-07	7.45364E-08
April	3	8.16463E-08	5.87573E-08	1.34839E-07	7.02202E-08
April	4	7.9906E-08	5.74865E-08	1.31915E-07	6.87023E-08
April	5	5.01187E-08	3.36343E-08	6.54659E-08	3.75009E-08
April	6	3.91276E-08	2.62579E-08	5.11033E-08	2.92759E-08
April	7	3.88736E-08	2.60911E-08	5.07796E-08	2.90872E-08
April	8	8.97564E-08	6.30398E-08	1.43065E-07	7.534E-08
April	9	1.03552E-07	4.94199E-08	7.49026E-08	5.90096E-08
April	10	2.57918E-08	1.87677E-08	5.0761E-08	2.16871E-08
April	11	1.87199E-06	8.78928E-07	1.25383E-06	1.04951E-06
April	12	1.59688E-07	6.67296E-08	7.03776E-08	7.46781E-08
April	13	1.44836E-07	6.05991E-08	6.39007E-08	6.77617E-08
April	14	1.65832E-07	6.92883E-08	7.30757E-08	7.75488E-08
April	15	1.62896E-07	6.8159E-08	7.18744E-08	7.62107E-08
April	16	1.32212E-07	5.94732E-08	8.23445E-08	7.1012E-08
April	17	1.22542E-07	5.51192E-08	7.6317E-08	6.58206E-08
April	18	1.46772E-07	4.78386E-08	6.78552E-08	5.71183E-08
April	19	1.59051E-07	5.17981E-08	7.34788E-08	6.18802E-08
April	20	1.58268E-07	6.53811E-08	8.8019E-08	7.80806E-08
April	21	8.08599E-08	4.83608E-08	9.05397E-08	5.59703E-08
April	22	6.29818E-07	3.41335E-07	7.72631E-07	3.79634E-07
April	23	7.33177E-08	8.94483E-08	6.32792E-08	9.94513E-08
April	24	9.87888E-08	7.56355E-08	1.34024E-07	8.6307E-08
April	25	6.09891E-08	4.59845E-08	8.1528E-08	5.30743E-08
April	26	4.77945E-08	2.94743E-08	5.71961E-08	3.38552E-08
April	27	9.18057E-08	6.31067E-08	1.09941E-07	6.99649E-08
April	28	7.78951E-08	3.8137E-08	7.0652E-08	4.27846E-08
April	29	1.25779E-07	4.40973E-08	6.57156E-08	5.03625E-08
April	30	2.05083E-08	1.92553E-08	3.93442E-08	2.23288E-08
April	31	4.09064E-07	3.15943E-07	5.49435E-07	3.50961E-07
April	32	1.52936E-07	7.2757E-08	1.15009E-07	8.27074E-08
April	33	8.96198E-08	6.08418E-08	1.12766E-07	6.98186E-08
April	34	1.47333E-07	9.83129E-08	2.18236E-07	1.08271E-07
April	35	1.65162E-07	1.1023E-07	2.44675E-07	1.21377E-07
April	36	1.13052E-07	9.55237E-08	2.15418E-07	1.05141E-07
April	37	1.20763E-07	1.01974E-07	2.30003E-07	1.1231E-07
April	38	1.09444E-07	4.94946E-08	8.07109E-08	5.68371E-08
April	39	1.126E-07	7.05057E-08	1.07296E-07	7.81922E-08
April	40	7.40397E-08	4.61536E-08	8.66724E-08	5.24687E-08
April	41	8.63078E-08	5.38011E-08	7.43525E-08	6.11625E-08
April	42	4.25742E-08	4.5541E-08	1.01985E-07	5.22418E-08
April	43	1.13702E-07	1.3327E-07	2.99481E-07	1.47706E-07
April	44	7.86547E-08	7.50759E-08	1.76337E-07	8.52688E-08
April	45	1.52832E-08	1.07674E-08	2.35994E-08	1.2448E-08
April	46	3.92039E-08	3.13957E-08	1.02667E-07	3.45621E-08
April	47	1.76438E-07	8.06993E-08	1.27306E-07	9.17256E-08
April	48	1.22218E-07	5.52717E-08	9.01318E-08	6.34715E-08
April	49	3.243E-08	3.19563E-08	7.02631E-08	3.66595E-08
April	50	5.95788E-08	6.03221E-08	1.76553E-07	6.68426E-08
April	51	7.36064E-08	8.96927E-08	9.02567E-08	9.94272E-08

2017 MOVES Emission Rates (grams/second/meter^2)
July

Month	MOVESlinkID	AM	MD	PM	NT
July	1	8.92813E-08	6.90832E-08	1.65657E-07	7.43689E-08
July	2	9.63105E-08	5.94966E-08	1.65042E-07	6.47962E-08
July	3	7.11727E-08	5.7618E-08	1.30145E-07	6.20568E-08
July	4	6.96498E-08	5.63717E-08	1.27322E-07	6.07149E-08
July	5	4.6064E-08	3.32507E-08	6.41597E-08	3.4747E-08
July	6	3.59628E-08	2.59585E-08	5.00837E-08	2.71264E-08
July	7	3.57318E-08	2.57939E-08	4.97677E-08	2.69533E-08
July	8	7.82359E-08	6.18174E-08	1.38084E-07	6.65803E-08
July	9	9.01231E-08	4.84668E-08	7.23988E-08	5.21802E-08
July	10	2.31785E-08	1.84774E-08	4.93443E-08	1.9608E-08
July	11	1.62925E-06	8.61976E-07	1.21192E-06	9.28028E-07
July	12	1.46163E-07	6.59411E-08	6.89426E-08	6.90174E-08
July	13	1.3265E-07	5.98882E-08	6.26079E-08	6.26603E-08
July	14	1.51775E-07	6.84683E-08	7.15843E-08	7.16654E-08
July	15	1.49198E-07	6.73599E-08	7.04212E-08	7.04761E-08
July	16	1.15077E-07	5.83265E-08	7.95949E-08	6.27945E-08
July	17	1.06652E-07	5.40555E-08	7.37663E-08	5.81994E-08
July	18	1.2815E-07	4.69145E-08	6.56079E-08	5.05094E-08
July	19	1.38819E-07	5.07943E-08	7.10372E-08	5.46999E-08
July	20	1.38175E-07	6.41191E-08	8.49544E-08	6.90367E-08
July	21	7.22829E-08	4.76044E-08	8.81365E-08	5.0551E-08
July	22	5.7951E-07	3.37549E-07	7.57973E-07	3.52356E-07
July	23	6.74814E-08	8.84591E-08	6.20834E-08	9.23266E-08
July	24	8.91946E-08	7.45762E-08	1.30822E-07	7.87068E-08
July	25	5.46168E-08	4.528E-08	7.94016E-08	4.80249E-08
July	26	4.3017E-08	2.90392E-08	5.58209E-08	3.07352E-08
July	27	8.47436E-08	6.24291E-08	1.07871E-07	6.50801E-08
July	28	7.12577E-08	3.76764E-08	6.9171E-08	3.94744E-08
July	29	1.13474E-07	4.34752E-08	6.41886E-08	4.59004E-08
July	30	1.83316E-08	1.89495E-08	3.82514E-08	2.01399E-08
July	31	3.76674E-07	3.12481E-07	5.39123E-07	3.26019E-07
July	32	1.38088E-07	7.17696E-08	1.12382E-07	7.56204E-08
July	33	8.05959E-08	5.99503E-08	1.09971E-07	6.34256E-08
July	34	1.36692E-07	9.73274E-08	2.1444E-07	1.01178E-07
July	35	1.53253E-07	1.09127E-07	2.40424E-07	1.13437E-07
July	36	1.04936E-07	9.45721E-08	2.11699E-07	9.8291E-08
July	37	1.12046E-07	1.00951E-07	2.26004E-07	1.04947E-07
July	38	9.85061E-08	4.87652E-08	7.87708E-08	5.16081E-08
July	39	1.03913E-07	6.97463E-08	1.05268E-07	7.27175E-08
July	40	6.71287E-08	4.55269E-08	8.46557E-08	4.79711E-08
July	41	7.82517E-08	5.30707E-08	7.26224E-08	5.59196E-08
July	42	3.82875E-08	4.48756E-08	9.94574E-08	4.74698E-08
July	43	1.04698E-07	1.31844E-07	2.94012E-07	1.37424E-07
July	44	7.11123E-08	7.40644E-08	1.72309E-07	7.80094E-08
July	45	1.37279E-08	1.06003E-08	2.29365E-08	1.12511E-08
July	46	3.63929E-08	3.10825E-08	1.00871E-07	3.23068E-08
July	47	1.59969E-07	7.96053E-08	1.24344E-07	8.38728E-08
July	48	1.10004E-07	5.44572E-08	8.79653E-08	5.76318E-08
July	49	2.91578E-08	3.14891E-08	6.85215E-08	3.33099E-08
July	50	5.48591E-08	5.9678E-08	1.7333E-07	6.21983E-08
July	51	6.77744E-08	8.8731E-08	8.86086E-08	9.24938E-08

2017 MOVES Emission Rates (grams/second/meter^2)
October

Month	MOVESlinkID	AM	MD	PM	NT
October	1	1.40236E-07	9.15772E-08	2.22607E-07	1.12851E-07
October	2	1.38659E-07	8.20374E-08	2.13026E-07	1.03351E-07
October	3	1.11294E-07	7.65078E-08	1.78437E-07	9.43726E-08
October	4	1.08938E-07	7.48546E-08	1.74567E-07	9.23348E-08
October	5	6.15955E-08	3.96219E-08	7.76112E-08	4.56482E-08
October	6	4.80861E-08	3.09314E-08	6.05824E-08	3.56352E-08
October	7	4.7767E-08	3.07307E-08	6.01904E-08	3.54004E-08
October	8	1.22367E-07	8.20869E-08	1.89323E-07	1.01256E-07
October	9	1.41564E-07	6.42701E-08	9.81576E-08	7.9216E-08
October	10	3.31895E-08	2.32885E-08	6.39126E-08	2.78384E-08
October	11	2.55911E-06	1.14308E-06	1.64305E-06	1.40892E-06
October	12	1.97973E-07	7.90379E-08	8.37192E-08	9.14252E-08
October	13	1.7933E-07	7.16906E-08	7.5921E-08	8.2854E-08
October	14	2.05621E-07	8.20799E-08	8.69417E-08	9.49546E-08
October	15	2.01671E-07	8.06273E-08	8.53871E-08	9.31762E-08
October	16	1.80717E-07	7.73413E-08	1.07884E-07	9.53244E-08
October	17	1.67521E-07	7.16906E-08	1.00008E-07	8.83689E-08
October	18	1.9948E-07	6.22078E-08	8.87065E-08	7.66693E-08
October	19	2.16321E-07	6.74096E-08	9.6134E-08	8.31216E-08
October	20	2.15145E-07	8.50466E-08	1.16479E-07	1.04839E-07
October	21	1.05139E-07	6.01441E-08	1.12866E-07	7.20031E-08
October	22	7.72231E-07	4.00646E-07	9.09258E-07	4.60345E-07
October	23	8.98391E-08	1.04939E-07	7.44255E-08	1.20531E-07
October	24	1.25948E-07	9.21605E-08	1.63793E-07	1.08792E-07
October	25	7.90271E-08	5.69632E-08	1.01286E-07	6.80129E-08
October	26	6.13183E-08	3.62583E-08	6.99778E-08	4.30858E-08
October	27	1.11798E-07	7.37278E-08	1.29241E-07	8.44181E-08
October	28	9.66837E-08	4.53341E-08	8.44328E-08	5.25779E-08
October	29	1.6061E-07	5.3799E-08	7.99167E-08	6.35633E-08
October	30	2.66696E-08	2.40144E-08	4.9488E-08	2.88043E-08
October	31	5.00756E-07	3.70173E-07	6.45579E-07	4.24758E-07
October	32	1.94966E-07	8.81653E-08	1.39444E-07	1.03674E-07
October	33	1.15164E-07	7.47428E-08	1.38749E-07	8.87334E-08
October	34	1.77453E-07	1.13735E-07	2.53599E-07	1.29258E-07
October	35	1.98872E-07	1.27492E-07	2.84262E-07	1.44868E-07
October	36	1.36026E-07	1.10418E-07	2.50062E-07	1.25409E-07
October	37	1.45441E-07	1.1798E-07	2.67256E-07	1.34092E-07
October	38	1.40405E-07	6.08648E-08	9.87412E-08	7.23084E-08
October	39	1.3719E-07	8.24095E-08	1.26204E-07	9.43909E-08
October	40	9.36031E-08	5.59326E-08	1.05429E-07	6.5775E-08
October	41	1.09113E-07	6.52006E-08	9.04429E-08	7.66737E-08
October	42	5.47091E-08	5.59178E-08	1.25485E-07	6.63611E-08
October	43	1.39191E-07	1.55626E-07	3.50494E-07	1.78127E-07
October	44	1.00005E-07	9.08605E-08	2.13803E-07	1.06747E-07
October	45	1.96857E-08	1.33699E-08	2.97522E-08	1.59892E-08
October	46	4.71614E-08	3.62992E-08	1.1939E-07	4.12348E-08
October	47	2.23058E-07	9.7774E-08	1.54856E-07	1.14959E-07
October	48	1.56794E-07	6.79692E-08	1.10267E-07	8.07486E-08
October	49	4.16923E-08	3.92394E-08	8.64529E-08	4.65696E-08
October	50	7.29393E-08	7.04197E-08	2.0662E-07	8.05834E-08
October	51	9.01159E-08	1.04768E-07	1.05631E-07	1.19942E-07

Attachment D:
MOVES and AERMOD Input Data Assumptions and Parameters

Data Checklist
MOVES Project-Level Emission Modeling

Data Item	Inputs Needed/Assumptions	Data Source
MOVES RunSpec		
Scale/Calulation Type	Project Scale Emission Rates Run	
Analysis County	Marion County (FIPS: 18097)	
Analysis Years	2017	
Representative Months	January (Jan-Mar), April (Apr-Jun), July (Jul-Sep), October(Oct-Dec)	
Representative Hours	6 am (6am-9am), 12 pm (9am-4pm), 6 pm(4pm-7pm), 12 am(7pm-6am)	
Number of Runs	4 hours of a weekday x 4 quarters = 16 runs per scenario	
Pollutants and Processes	Primary Exhuast PM2.5 - Total; Running Exhaust & Crankcase Running Exhaust Primary PM2.5 - Brakewear Particulate Primary PM2.5 - Tirewear Particulate	
Stage II Refueling Emissions	Not Applicable	
Fuel Types	Gasoline, Diesel, CNG	
Traffic Data		
Highway Network	Required traffic volume, speed, distance and facility type by time period (AM/PM peak and daily average) for each link. Average speed will be estimated using traffic volume and traffic delay from model network.	- Regional Travel model runs received from Indianapolis MPO (Catherine Kostyn) on 6/12/2014 and 6/24/2014
MOVES Inputs		
Fuel Supply	Use MOVES defaults (Marion County's fuel inputs for regional analysis as provided by Indianapolis MPO are based on MOVES defaults)	- MOVES inputs received from Indianapolis MPO (Catherine Kostyn) on 5/9/2014 (Marion County)
Fuel Formulation		
I/M Parameters	Not Applicable	
Vehicle Age Distribution	Use same inputs as developed for PM2.5 SIP (Marion County inputs)	
Temperatures/Humidity	Average meteorology data for each hour for each representative time period. Use same inputs as developed for recent PM2.5 SIP/regional analysis.	
Links	Average speed, traffic volume, distance and road type (facility type) for each link. Examine traffic network to define representative links based on geographic and vehicle activity parameters (e.g. traffic volume, congested speed, acceleration, deceleration, cruise, idle, etc.) Grade: Calculated based on link length and elevation data	
Link Source Type	Distribution of source type population for each link. Use traffic volumes from traffic network and regional fleet distribution (based on MOVES source type population input for regional analysis) to calculate link source type distribution.	MOVES data received from Indianapolis MPO (Catherine Kostyn) on 5/9/2014
Link Drive Schedule	Not Applicable	
Operating Mode Distribution	Not Applicable	
Off-Network Link	Not Applicable	
Control Programs		
Early NLEV / CALLEVII	Not Applicable	
Stage II Refueling Parameters	Not Applicable	

Data Checklist

AERMOD Dispersion Modeling

Data Item	Inputs Needed/Assumptions	Data Source
Analysis		
Air Quality Dispersion Model	AERMOD (Dated 12345)	Downloaded from EPA's SCRAM website (http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod)
Key AERMOD Inputs		
Modeling Options	Modle concentration and assume flat terrain	
Pollutant	PM 2.5	
Averaging Period	Annual	
Receptor Height	1.8 meters	Per FHWA PM2.5 Hot-Spot 3 Days Training Document
Emission Source Type	Model roadway links as "Area" sources, and use "AREAPOLY" option to specify area sources.	
Release Height	1.3~1.8 meters (estimated using a volume-weighted avearge for each link). Assume release height is 1.3 meters for light duty vehicles and 3.4 meters for heavy duty vehicles.	Per FHWA PM2.5 Hot-Spot 3 Days Training Document
Initial Vertical Dispersion Coefficient	1.2~1.7 meters (estimated using a volume-weighted avearge for each link). Assume coefficient is 1.2 meters for light duty vehicles and 3.2 meters for heavy duty vehicles.	Per FHWA PM2.5 Hot-Spot 3 Days Training Document
Emission Rates	Emission factors (g/s/m2) by season and hour of day derived from MOVES outputs	
Receptors	Receptor are placed per PM Hot-Spot Guidance and considering sensitive populations: First receptor network is within 5-80 meters of the roadway edges with 15 meters of spacing among receptors. Second receptor network is within 80-500 meters of the roadway edges with 75 meters of spacing among receptors.	Per EPA Quantitative PM Hot-Spot Analyses Guidance
Meteorology Data (*.sfc & *.pfl)	Use 5 most recent available years (2006-2010) of off-site meteorological data available from IDEM website: - Surface meteorological data is from the National Weather Service Site for Indianapolis, IN - Upper air meteorological data is from Lincoln, IL station.	Downloaded from IDEM website (http://www.in.gov/idem/airquality/2376.htm)

Attachment E:
AERMOD Outputs for Top 10 and Lowest Receptors

2017 AERMOD Outputs

Rank	X	Y	AERMOD Modeling Results (µg/m³)
1	985669	490563	0.76297
2	985656	490582	0.73799
3	985643	490602	0.69274
4	985669	490576	0.66005
5	985682	490556	0.65903
6	985630	490621	0.655
7	985656	490595	0.64026
8	985617	490641	0.61383
9	985643	490615	0.60693
10	985682	490569	0.5883
Lowest	984199	492071	0.01179

Attachment F:
Public Comment Notices and Affidavits

<Notices and Affidavits Begin on Following Page>